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SOME SOCIO-DEMOGRAPHICS AND MALARIA PARASITAEMIA AMONG PREGNANT WOMEN AT THEIR FIRST ANTENATAL CARE VISIT IN WARRI, NIGERIA

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ABSTRACT
This study investigated the association of some socio-demographic features with peripheral malaria parasitaemia among pregnant women at booking for antenatal care in a secondary hospital in Warri, southern Nigeria. Two hundred and forty (240) patients, aged between 15 and over 40years, were enrolled into this study between April and June 2015. Their mean age was 29.38 $\pm$ 0.39 years. Blood samples were collected and examined to determine the presence or absence of malaria parasites using standard methods. Copies of structured questionnaire were administered to the patients to obtain their socio-demographic characteristics. The species of *Plasmodium* isolated from the pregnant women were; *P. falciparum* (97.6%) and *P. malariae* (2.4%). Overall prevalence of microscopic *Plasmodium* sp. among the pregnant women was 50.8%. The mean malaria parasites density was 2119.09 $\pm$ 329.23 parasites/µL blood. The prevalence of malaria parasitaemia was highest (62.2%) among women with the first pregnancy (primigravidae) and lowest among the multigravidae (40.5%) ($P < 0.001$). Parasitaemia peaked in the age group 25-29 years (55.4%) and decreased with advancing age. No significant relationship ($P>0.05$) was established between malaria parasitaemia and maternal age and trimester of pregnancy. However, other socio-demographic characteristics of the pregnant women, namely, gravidity, maternal residence (urban/rural), occupation, educational status and usage of insecticide-treated bed nets at home, recorded high significant association ($P<0.001$) with malaria parasitaemia. Any strategy aimed at effectively combating malaria during pregnancy should address not only the direct causal factors but also recognise the contribution of relevant socio-demographic characteristics of the women.

Key words: *Socio-demographics, Malaria parasitaemia, Ante natal care, Warri, Nigeria*

INTRODUCTION
Malaria is an infectious disease caused by species of the protozoan parasite; *Plasmodium*. According to the World Health Organization (2015) report, globally, 3.2 billion people were at risk of malaria but the number of clinical cases of malaria was estimated to be 214 million in 2015 resulting in 438,000 deaths. In addition, sub-Saharan Africa continued to shoulder the heaviest malaria burden as an estimated 88% of

malaria cases in 2015 occurred in the region. Furthermore, pregnant women and children under 5 years had the highest morbidity and mortality rates.

Malaria is transmitted by the bites of infected female anopheline mosquitoes. Factors that influence mosquito breeding, such as consistent high temperature, high humidity and rainfall, along with stagnant water, affect malaria incidence and transmission (Schantz-Dunn and Nour, 2009).

The ill-effects of malaria on pregnant women and children under five differ according to transmission and immunity levels. In areas of low or unstable transmission (hypoendemic regions), pregnant women are more susceptible to severe forms of malaria because acquired immunity is low or nonexistent, and will develop clinical cases when parasitaemic. In areas of high or stable transmission (hyperendemic regions), most adult women have developed an adequate level of immunity. Most infections although asymptomatic result in maternal morbidity and malaria related anaemia (WHO, 2015).

Untreated infections can result in abortion, still-birth, premature labour or low birth weight. Cerebrial malaria, pulmonary oedema and hypoglycaemia frequently occur (Cot and Deloron, 2003). Pregnant women are three times more likely to suffer from severe disease as a result of malaria infection compared with non-pregnant women (Juliana and Nawal, 2009).

Control measures aimed at reducing the burden of malaria in pregnancy include: intermittent preventive therapy (IPT), usage of insecticide-treated nets (ITNs), effective case management/antenatal care (ANC), use of appropriate drugs and effective educational outreach programmes (Schantz-Dunn and Nour, 2009; Tay *et al*., 2013; WHO, 2015). These control measures are beneficial because they reduce the overall malaria exposure, both for pregnant women and the general population.

Generally, very little is known about the contribution of some socio-demographic features to the increased prevalence and burden of malaria during pregnancy in the Niger Delta region of Nigeria. This study was undertaken to investigate the effects of some social, personal/biological and environmental characteristics on peripheral malaria parasitaemia among pregnant women in the study area. Information from the study should motivate both the health care providers and women to evolve additional strategies to curb the spread or alleviate the burden of this preventable infectious disease, thereby improving on maternal and perinatal health in the region.

MATERIALS AND METHODS

Study Area

Warri is an industrial town and it has a major port on Warri River. It lies approximately on longitude 5^0 45′E and latitude 5^0 31′N. The vegetation is a combination of rainforest and mangrove swamp forest of the Niger Delta zone of Southern Nigeria. The climate is tropical, with two annual seasons, the dry (November-March) and the rainy (April-October) seasons. It has a mean annual temperature of 32.8°C and annual rainfall of 2673.8mm. Besides the Warri River and its tributaries that flow through it, Warri metropolis is characterised by the presence of numerous stagnant pools, water channels and creeks.

This cross sectional observational study was conducted at the General Hospital Warri; a government owned secondary health-care facility and a reference centre to many clinics in the area.

Study Population

The study population comprised of pregnant women, aged between 15 and over 40 years at their first antenatal care visit at the General Hospital, Warri, between the months of April and June 2015 coinciding with the onset of the rainy season. Prior to the commencement of the study, ethical clearance was obtained and the research was endorsed by the Ethical Committee of the Hospital. Two hundred and forty (240) pregnant women, who were not on any form of malaria treatment, not positive for human immunodeficiency virus (HIV) and not having sickle cell anaemia, were enrolled consecutively at booking into the study, after a non-coercive informed consent. Simple random sampling method was used to obtain the sample size.

Blood Sample Collection

The volar surface of the arm was cleaned with cotton wool moistened with 70% alcohol and 5ml of peripheral blood was drawn into EDTA bottle with sterile hypodermic needle. Thin and thick blood smears were made from each of these samples, for all the pregnant women on clean slides and labelled.

Microscopic Examination

The thin films were fixed with methanol and stained with freshly prepared Giemsa stain and then examined under the microscope using x100 objective lens. The identification of the species of *Plasmodium* (malaria parasite) was done using the thin blood smear. The malaria parasites density was determined using the thick blood smear by estimating parasites numbers per microlitre (µL) of blood as described by Cheesbrough (2006). The degree of parasitaemia was graded thus: Parasites <1,000/µL as low; Parasites 1,000-10,000/µL as moderate, Parasites > 10,000/µL as high.

Information on the demography, bio-data and obstetric history of the pregnant women were obtained and recorded using an interviewer administered questionnaire. Gestational age of pregnancy or trimester was defined as follows: first trimester (<14weeks), second trimester (14-27 weeks) and third trimester (>27weeks). Trimester was calculated from the time of the last menstrual period.

Statistical Analysis

Results were presented as simple percentages. Statistical significance of data was done using Chi-square test and ANOVA where applicable. P-values $\leq$ 0.05 were considered significant.

RESULTS

Two hundred and forty (240) pregnant women were enrolled into the study. The maternal age ranged from 15 to over 40 years. The mean age of the women was 29.38$\pm$ 6.047 years. The largest age group was 25-29 years (27.08%) while the least group was those of 40years and above (7.92%).

The species of *Plasmodium* found in the pregnant women were: *P. falciparum* (97.6%) and *P. malariae* (2.4%). A total of 122 (50.83%) of the pregnant women were confirmed positive at booking, for peripheral malaria parasites. The prevalence of malaria parasitamia rose from the first age group, 15-19years (34.78%) and peaked in the age group 25-29 years (55.38%), and then declined to 42.11% in the last group, 40 years and above (Table 1).

Table 1: The prevalence of malaria parasitaemia according to the age of pregnant women

		Malaria parasitaemia (%)	
Age (years)	Number Examined (%)	Number Positive	Number Negative
15-19	23 (9.58)	8 (34.78)	15(65.22)
20-24	57(23.75)	31(54.39)	26(45.61)
25-29	65(27.08)	36(55.38)	29(44.62)
30-34	47(19.58)	26(55.32)	21(44.68)
35-39	29(12.08)	13(44.83)	16(55.17)
>40	19(7.92)	8(42.11)	11 (57.89)
TOTAL (%)	240(100)	122(50.83)	118(49.17)

Table 2 shows the prevalence of malaria parasitaemia according to trimester and gravidity at booking. The gestational age (trimester) of the pregnant women were as follows: 34.6% booked in the first trimester, 37.1% in the second trimester and 28.3% in the third trimester. The prevalence of malaria parasitaemia was highest in the second trimester (55.06%) while the lowest was in the third trimester (42.05%). There was no significant association (P>0.05) between trimester and the prevalence of malaria parasitaemia.

Table 2: The prevalence of malaria parasitaemia according to gestational age (trimester) and gravidity

		Malaria parasitaemia (%)	
	No. examined (%)	No. positive	No. negative
TRIMESTER			
First	83(34.58)	44(53.01)	39(46.99)
Second	89(37.08)	49(55.06)	40(44.94)
Third	68(28.34)	29(42.65)	39(57.35)
TOTAL (%)	240(100)	122(50.83)	118(49.17)
GRAVIDITY			
Primigravidae	90(37.50)	56(62.22)	34(37.78)
Secondigravidae	76(31.67)	36(47.37)	40(52.63)
Gravidae 3 and above	74(30.83	30(40.54)	44(59.46)
TOTAL (%)	240(100)	122(50.83)	118(49.17)

Among a total of 90 primigravidae (women with first pregnancy) 56(62.22%) recorded the highest prevalence of malaria parasitaemia while 30 women with three or more pregnancies (multigravidae) had the least prevalence (40.54%). Malaria parasitaemia decreased as parity increased. There was significant association (P<0.001) between gravidity and malaria parasitaemia.

The mean malaria parasites density in the study was 2119.09 ± 329.23 parasites/μL blood. Among the 122(50.83%) who were positive to malaria parasitaemia, 22.08% recorded low parasite density, 20.0% had moderate parasite density and 8.75% had high malaria parasitaemia.

Fig. 1 shows the number of malaria parasites/μL blood according to trimester and gravidity at booking. For the trimester, the highest prevalence of low, moderate and high parasites densities were recorded in the second, first and third trimesters respectively. For gravidity, in the gravidae 3 and above category, the prevalence of parasites densities declined sharply (73.33% >26.67%> 0.0%) in the low, moderate and high parasites densities respectively There was a significant association (P<0.001) between gravidity and density of malaria parasites.

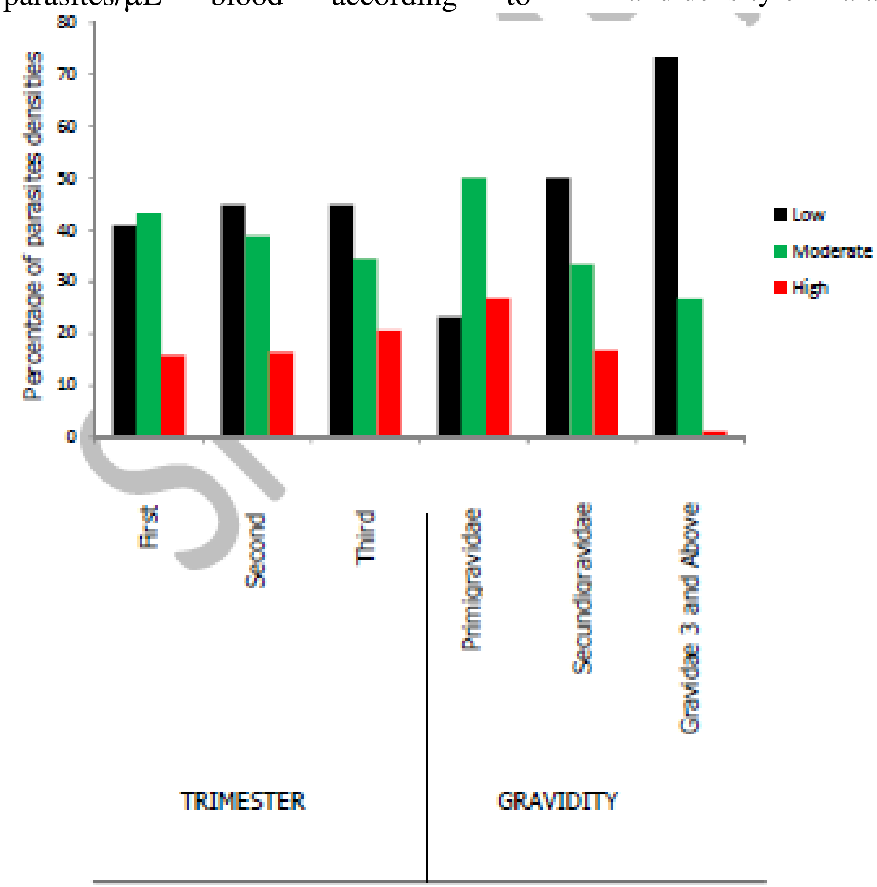

Fig. 1: Malaria parasites densities according to trimester and gravidity at booking

Table 3 shows the prevalence of malaria parasitaemia by parity and trimester. The prevalence of malaria parasitaemia was highest in primigravidae irrespective of the stage of pregnancy (trimester). The table also showed that malaria parasitaemia decreased as parity increased.

Table 3: The prevalence of malaria parasitaemia by parity and stage of gestation (trimester)

	Trimester		
Parity	1	2	3
0	$^{25}/_{32}$ (78.13)*	$^{16}/_{27}$ (59.26)	$^{15}/_{31}$ (48.39)
1	$^{14}/_{21}$ (66.67)	$^{17}/_{31}$ (54.84)	$^{11}/_{24}$ (45.83)
2+	$^{5}/_{30}$ (16.67)	$^{16}/_{31}$ (51.61)	$^{3}/_{13}$ (23.08)

*No. positive/ No. examined (% positive)

Fig. 2 shows the prevalence of malaria parasitaemia according to maternal residence. Most 132 (55.0%) of the study subjects resided in the urban area while 108 (45.0%) of the pregnant women resided in the rural areas. Pregnant women who lived in the urban area recorded a higher prevalence (62.12%) of malaria parasitaemia than the rural dwellers (37.04%). In terms of malaria parasites density, the urban dwellers recorded the least prevalence (12.20%) of high parasitaemia while rural dwellers had the highest prevalence (57.50%) of low parasitaemia. There was a significant association (P<0.001) between maternal residence and peripheral malaria parasitaemia.

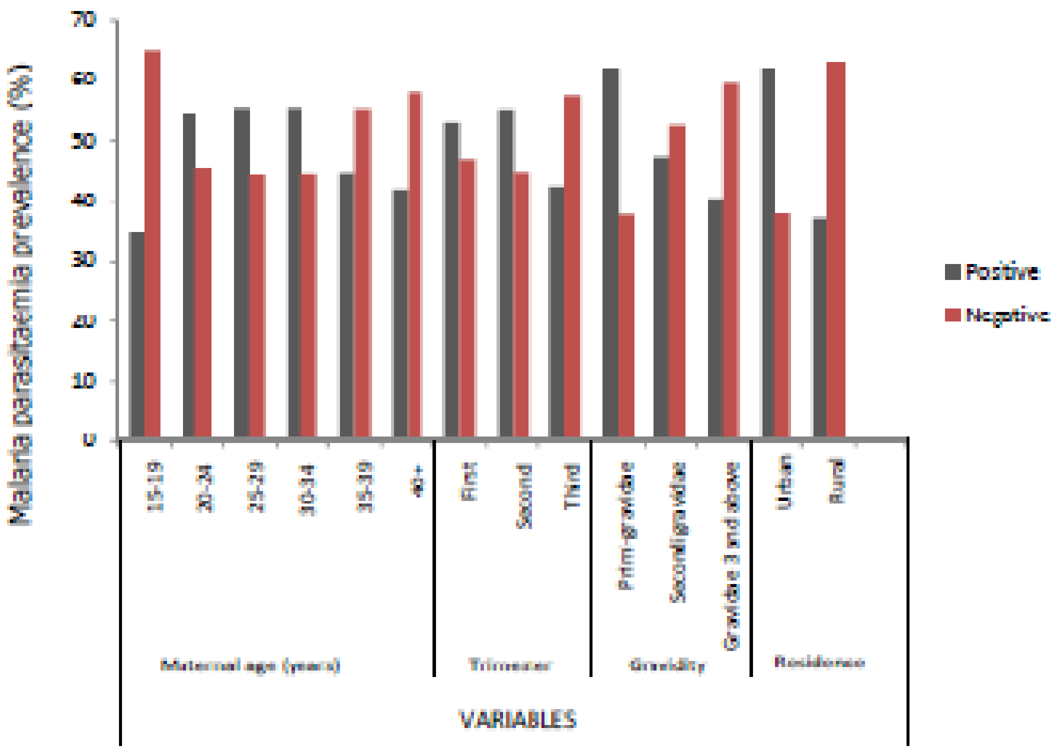

Fig. 2: The prevalence of malaria parasitaemia and socio-demographic variables: maternal age, trimester, gravidity and residence of pregnant women.

Pregnant women in the study were from different professional groups (Fig. 3). Most women (41.67%) were traders and the least were farmers (12.08%).

The highest prevalence of malaria parasitaemia (68.97%) was recorded by farmers, closely followed by traders (63.0%) and the least was for full-time housewives (25.88%). There was a significant association (P<0.001) between maternal occupation and prevalence of malaria parasitaemia.

Two hundred and sixteen (216) of the pregnant women (90%) were literate while 24(10%) were not literate. Most of the literate women (40.42%) had secondary school education. The highest prevalence of malaria parasitaemia (79.17%) was revealed among women with no formal education and the least prevalence (41.18%) among those with tertiary education (Fig. 3) The educational status of the pregnant women had a significant association (P<0.02) with the prevalence of malaria parasitaemia.

Most pregnant women (40.83%) had no bed nets, 22.5% and 36.6% used ordinary bed nets and insecticide-treated bed nets at home respectively. Pregnant women who had no bed nets at home recorded the highest prevalence of malaria parasitaemia (82.65%) while those who reportedly slept under insecticide-treated bed nets had the lowest prevalence (11.36%). There was a highly significant association (P<0.001) between usage of insecticide-treated bed nets and prevalence of peripheral malaria parasitaemia.

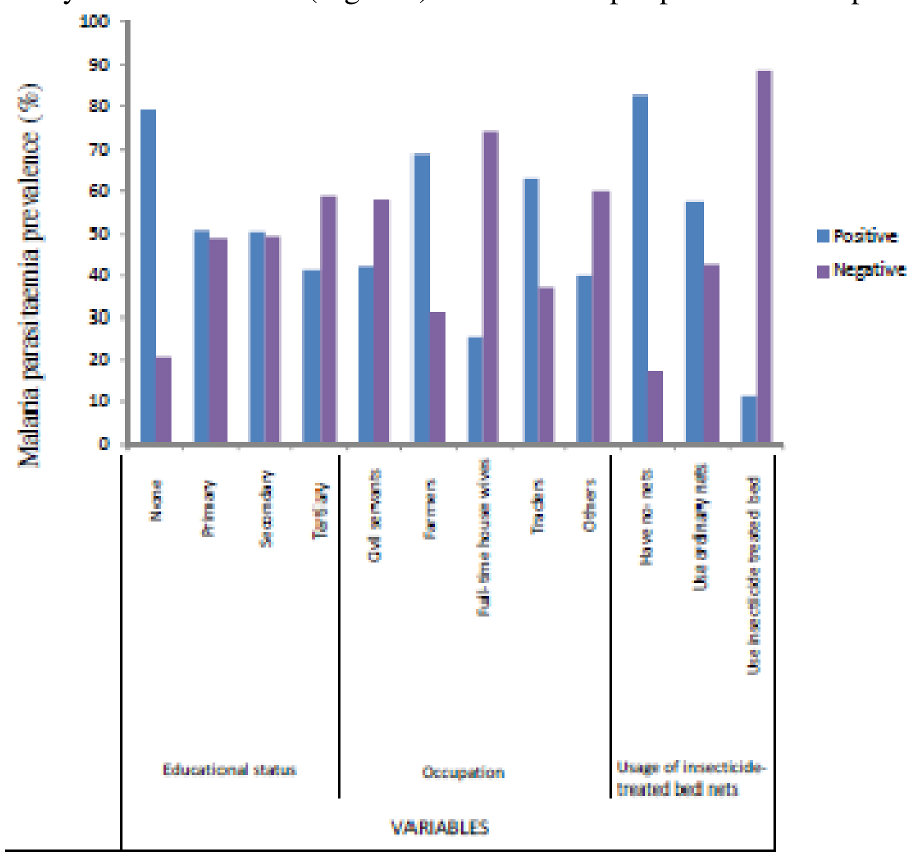

Fig. 3: The prevalence of malaria parasitaemia and socio-demographic variables – maternal educational status, occupation and usage of insecticide-treated bed nets among pregnant women.

DISCUSSION

The overall prevalence of peripheral malaria parasitaemia of 50.8% at booking, among pregnant women in this study is comparable to the 52% reported in a suburb of Lagos (Raimi and Kanu, 2010) and 54% reported in Southeast Nigeria (Nduka, *et al*., 2006), but much higher than 26% reported in Port Harcourt (Wogu, *et al*., 2013a), on the eastern zone of the Niger Delta. The difference in prevalence rates might be as a result of local ecological factors. Furthermore, this study was conducted between the months of April and June 2015, at the onset of the rainy season when malaria transmission was high in the area.

The main species of *Plasmodium* isolated in this study was *P. falciparum* which accounted for 97.5% of malaria infections. This finding is similar to the 97.8% *falciparum* malaria infection among pregnant women, reported in Sudan (Gabbad, *et al*., 2014); 92% in southern Mozambique (Saute *et al*., 2002) and 85.4% reported in Kumasi, Ghana (Tay *et al*., 2013). This finding confirms the assertion that *P. falciparum* is most prevalent in Africa and is responsible for the most severe morbidity and mortality (WHO, 2015).

Malaria parasitaemia differed among maternal age groups. Some studies have shown that maternal age was associated with increased risk of microscopic malaria parasitaemia. These have indicated that malaria parasitaemia was more prevalent in younger than older age groups among pregnant women (Bouyou-Akotet *et al*., 2003; Bako *et al*., 2009; De Beaudrap *et al*., 2013; Tay *et al*., 2013). Although not statistically significant, the prevalence of microscopic malaria parasitaemia tended to be more frequent among the younger age groups than in the older age groups. Indeed, the age group, 25-29years was the most vulnerable, recording the highest prevalence (55.4%) of malaria parasitaemia (Table 1). Findings from this study were similar to the results from other studies (Akinboro *et al*., 2010; Yahaya *et al*., 2009) which found no significant association between maternal age and malaria parasitaemia.

In high transmission areas, *P. falciparum* infection have been consistently demonstrated to be highest in women in their first (primigravidae) and second (secundigravidae) pregnancies, but with lower rates in later pregnancies (multigravidae) (Brabin, 1991; Steketee, 2001; Akinboro, *et al*., 2010; Tay, *et al*., 2013). Results from this study have confirmed the high susceptibility of primigravidae compared with the multigravidae. Prevalence of malaria parasitaemia was highest among the primigravidae (62.2%) and lowest among the multigravidae (40.54%). However, malaria parasitaemia positivity decreased as parity increased (Table 2).

Pregnancy and the physiological changes associated with it, especially the immunocompromised status has been shown to be a predisposing factor of malaria parasitaemia. Plasma antibodies from malaria exposed pregnant women recognised variant surface antigens on infected erythrocytes in a parity-dependent manner and blocked parasite adhesion to chondroitin sulphate A. This protective antibody develops over successive pregnancies (Duffy and Fried, 1999; Steketee *et al*., 2001). Women of low parity are therefore more susceptible to malaria parasitaemia due to lack of immune experience to malaria parasites infections when compared to the multigravidae. Women with successive births have been shown to develop efficient immunity against malaria parasites. Hence peripheral malaria parasitaemia have been reported to decrease with increasing parity among pregnant women (Brabin, 1991; De Beaudrap *et al.*, 2013).

Malaria parasite densities also changed with parity. Low parasite densities were most common in the multigravidae (73.3%) while those in the moderate and high densities were most common in the primigravidae, 50% and 26.7%, respectively (Fig. 1). There was a significant association ($P < 0.001$) between malaria parasite density and gravidity. Malaria parasitaemia was highest in primigravidae irrespective of the stage of pregnancy (trimester) (Table 3). Data from this table also confirmed the higher susceptibility of the primigravidae compared with the multigravidae, and that positivity to malaria parasitaemia decreased as parity increased.

Most of the pregnant women were late at booking for antenatal care (ANC) in the hospital. The percentage at registration in the second and third trimesters were, 37.08% and 28.34% respectively (Table 2). Late booking for ANC by pregnant women has been a common practice in Africa (Bako *et al.,* 2010; Tay *et al.,* 2013).

Pregnant women in the second trimester recorded the highest prevalence (55.06%) of malaria parasitaemia in this study. This finding is consistent with reports from other studies (Menendez, 1995; Singh, 2001; Schantz-Dunn and Nour, 2009; Raimi and Kanu, 2010; Agan *et al.*, 2010). However, no statistically significant association ($P>0.05$) was found between trimester and malaria parasitaemia. This finding is in agreement with reports from other studies (Akinboro *et al.*, 2010; De Beaudrap *et al.,* 2013) which have shown that trimester was negatively associated with the risk of malaria infection. Late booking for ANC by pregnant women is detrimental as it does not allow for early detection and correction of malaria associated complications during pregnancy before delivery.

Results from this study showed that pregnant women who lived in Warri metropolis recorded a higher prevalence of malaria parasitaemia (68.2%) than those residents in the rural areas (31.4%). There was a significant association ($P<0.001$) between maternal residence and malaria parasitaemia (Fig. 2). This finding differs from results reported in other studies which expectedly have shown that the risks of malaria parasitaemia were higher in mothers who lived in rural areas (De Beaudrap *et al.,* 2013; Gabbad *et al.,* 2014).

The disparity in prevalence of malaria parasitaemia among rural and urban dwellers probably reflects differences in endemicity of malaria arising from ecological and geographic factors. Warri town is a major port in the Niger Delta region of Nigeria and is replete with good health care facilities. However, besides the high temperature and humidity in the area, there are numerous creeks, nearby swamps and stagnant pools of water which provide favourable and consistent breeding sites for mosquitoes and therefore higher malaria parasites transmission. On the other hand, the rural areas are drier, more elevated hinterland, far removed from the breeding sites of mosquitoes and therefore recorded a lower malaria parasites transmission.

The prevalence of malaria parasitaemia varied with the professions of the pregnant women. Farmers recorded the highest prevalence of malaria parasitaemia (68.97%) while full time housewives had the least prevalence (25.58%) in this study (Fig.3). The difference was statistically significant (P<0.001). This finding is probably due to the observation that farmers are usually thinly dressed and often exposed most parts of their bodies for long periods to frequent mosquito bites. Malaria parasites infection is related to the degree of exposure to the bites of infected female anopheline mosquitoes. The results from this study corroborates with the report of Iriemenam *et al*., (2011) that the occupation of pregnant women had a strong association with malaria parasitaemia.

According to De Beaudrap *et al*., (2013), the risk of peripheral malaria parasites infection was increased in mothers who had a lower education level. In this study, 216 (90%) of the pregnant women were literate and only 24(10%) had no formal education (Fig.3). Furthermore, pregnant women with no formal education recorded the highest prevalence (79.17%) of malaria parasitaemia while those with tertiary education had the least prevalence (41.18%). The difference was statistically significant (P<0.02).

This finding differs from those of some authors (Falade *et al*., 2008; Iriemenam *et al*., 2011) who reported no significant association between malaria infection and the level of education of pregnant women. In this study, there was an important link between maternal educational status and occupation. Most of the farmers, 24/29 (82.8%) had no formal education. Therefore, the highest prevalence of malaria parasitaemia recorded among women with no formal education was probably an indirect effect arising from the higher exposure to mosquito bites in their occupation. It could also be argued that the literate pregnant women would have been better informed about anti-malaria measures including bed nets, insecticide spraying, insect repellents etc. and so might have used them. The use of insecticide-treated nets (ITNs) reduce human-vector contact by physically excluding vector mosquitoes, killing them if they land on ITNs or repelling them, thereby driving them away. There are documented positive effects in several studies of the usage of ITNs and reduction of malaria parasitaemia (ter Kuile *et al*., 2003; Wogu *et al*., 2013b). When ITNs are used by pregnant women, they are also efficacious in reducing malaria related illness such as anaemia, placenta infection and low birth weight (WHO, 2015).

In this study, pregnant women who did not use bed nets at home had the highest prevalence (82.7%) of malaria parasitaemia while the least prevalence (11.4%) was recorded by women who used ITNs (Fig.3). The difference was statistically significant (P<0.001). Whereas an estimated proportion of the population sleeping under an ITN in 2015 for countries in sub-Saharan Africa was 55% (WHO, 2015), only 36.7% of the pregnant women in this study used ITNs. The cost and unavailability of ITNs might be the major reasons for most pregnant women not using them.

CONCLUSION

Some socio-demographic characteristics of pregnant women have important contributions to the prevalence of malaria parasitaemia. These factors should be effectively incorporated into all strategies on local malaria intervention programmes to reduce the burden of malaria among pregnant women and their offspring. Late booking for ANC, absence of intermittent preventive treatment (IPT) and low usage of ITNs at the time of this study may also have contributed to the high prevalence of malaria parasitaemia among the study subjects.

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